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Clifford N. Click

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EXAMINER

KENDALL, CHUCK O

ART UNIT

PAPER NUMBER

2122

DATE MAILED: 03/23/2004

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Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/872,456

Applicant(s) *PRG*

CLICK ET AL.

Examiner

Chuck O Kendall

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 05 January 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

1. This action is in response to the application filed 01/5/04.
2. Claims 1 – 20 have been examined.

### Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

4. Claims 1 – 3, 7 – 13, 16 – 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Geva USPN 6,539,541 B1 art of record.

Regarding claim 1, Geva anticipates a method (FIG. 5), system (FIG.1) for loop optimization within a dynamic compiler system comprising:

executing a computer program having a loop structure, wherein the loop structure includes a loop exit test to be performed during each loop iteration (8:1 – 20, see 10: 10 – 15, for loop exit test during each iteration, see counted loop);

compiling the loop structure during the execution of the computer program (4:15 – 29) based on the loop structure being often used (1: 33 – 35, see compile time constant, and also refer to 1:58 – 64, for large compile time constants which Examiner interprets as, the *loop structure being often used*); and

creating an unrolled loop structure during the compiling operation, (8:35 – 40, see “Unrolling the loop makes several iterations explicitly available to the compiler...”, wherein the unrolled loop structure includes plurality of loop bodies based on the original loop structure (See FIG.4B for plurality of loop bodies, see Body (i), Body (I +1), and Body (I +2)).

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Regarding claim 2, a method as recited in claim 1, wherein the unrolled loop structure includes the loop exit test (8:13).

Regarding claim 3, a method as recited in claim 2, wherein the loop exit test is performed once for each iteration of the plurality of loop bodies (8:1 – 10, see code).

Regarding claim 7, a method as recited in claim further including the operation of performing clean up (3:7).

Regarding claim 8, a method as in claim 7 wherein the loop clean-up includes optimizing multiple fall-in loop structures (3:1 – 10, see code structure).

Regarding claim 9, a method as recited in claim 7 wherein the loop clean-up includes optimizing nested loop structures having invariant structures (3:1 – 10, see code structure, 4:5 – 10 for loop invariant).

Regarding claim 10, Geva anticipates A dynamic compiling system, comprising:  
an interpreter capable of interpreting instructions of a computer program during execution of the computer program (4:65), the interpreter being further capable of requesting that a particular instruction be compiled (4:35 – 40) based on a predetermined number of repeated instructions (1: 25 – 35, for loops and iterations (repeated instructions, as interpreted), and also refer to 1:58 – 64, compile time constants, and trip counts); and

a compiler capable of compiling the instructions as requested by the interpreter, wherein the compiler is further capable of creating an unrolled loop structure when compiling an original loop structure of the computer program, wherein the unrolled loop structure includes a plurality of loop bodies based on the original loop structure (8:1 – 50).

Regarding claim 11, the system version of claim 2, see rationale as previously discussed above.

Regarding claim 12, the system version of claim 3, see rationale as previously discussed above.

Regarding claim 13, the system version of claim 4, see rationale as previously discussed above.

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Regarding claim 16, the computer program version of claim 1, see rationale as previously discussed above.

Regarding claim 17, the computer program version of claim 2, see rationale as previously discussed above.

Regarding claim 18, the computer program version of claim 7, see rationale as previously discussed above.

Regarding claim 19, the computer program version of claim 8, see rationale as previously discussed above.

Regarding claim 20, the computer program version of claim 9, see rationale as previously discussed above.

### **Claim Rejections - 35 USC § 103**

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 4 – 6, 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Geva USPN 6,539,541 B1 as applied in claim 1, in view of Srivastava USPN 5,457,799 art of record.

Regarding claims 4, Geva discloses all the claimed limitations as applied in claim 1 above. Geva doesn't explicitly disclose building a loop tree based on loops included in the computer program. However, Srivastava does disclose this limitation (4:7 – 15). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine Geva and Srivastava, because using loop regions in

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the form of trees would enable the program to process tree like structures (Srivastava 4:10 – 15).

Regarding claim 5, a method as recited in claim 4, wherein nested loops are represented in the loop tree as child nodes (Geva, 8:1 – 10, see code).

Regarding claim 6, a method as recited in claim 5 wherein parallel loops are represented in the loop as nodes level of the loop tree (Geva, 8:24, see parallelism).

Regarding claim 14, the system version of claim 5, see rationale as previously discussed above.

Regarding claim 15, the system version of claim 6, see rationale as previously discussed above.

### ***Response to Arguments***

7. Applicant's arguments filed 01/05/04 have been fully considered but are not persuasive to overcome previous rejection based on art of record.

Argument (1), Applicant argues in claims 1 and 10, that Geva doesn't disclose "compiling the loop structure during the execution of the computer program based on the loop structure being often used".

Response (1) Examiner believes that Geva does teach this limitation. As set forth above in claim 1, Geva shows in 1: 33 – 35, a compile time constant, which is the predetermined number of iterations the loop executes as determined by the compiler, that the compiler uses during optimization. Examiner interprets compiling "based on the loop structure being often used" as compilation based on higher trip counts, which are higher compile time constants (loop structure being often used), also see 1:58 – 64.

Argument (2), Applicant also argues in claim 10, that Geva doesn't disclose compilation "based on a predetermined number of repeated instructions".

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Response (2), Examiner again believes that Geva does teach this as well. As set forth in claim 10 above, and as recited in Geva in 1: 33 – 35, Examiner interprets the predetermined number of repeated instructions to be counted loop, iterations and/or trip count as described in Geva also see 1:58 – 64 and 10: 10 – 15.

Argument (3), Applicant argues in claim 4, for lack of motivation to combine references.

Response (3), Examiner believes that one of ordinary skill would in fact combine references to implement Applicants instant claimed invention. Geva's disclosure is concerned with Loop unrolling and optimizations as can be seen in the title "METHOD OF CONSTRUCTING AND UNROLLING SPECULATIVELY COUNTED LOOPS", the secondary Prior art used Srivastava also discloses optimizing program loops which can also be seen in the title, OPTIMIZER FOR PROGRAM LOOPS. Both References (Geva, and Srivastava), are analogous and deal with loop optimization technique's as does the Applicant's disclosure. Srivastava is provided along with Geva to teach Applicants limitation of *building a loop tree based on loops included in the computer program*. As set forth above Srivastava shows this difference. As recited in Srivastava 4: 9 – 14, "if the program call graph 300 were to have the form of a tree, the loop region of the tree would include the called procedure 321". Here Srivastava specifically notes if a tree structure exists, the loop region of the tree (loop tree based on loops) would include the called procedure (the computer program). Therefore, Examiner believes one would have made this combination if a tree structure were present.

### ***Conclusion***

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event; however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

### **Correspondence Information**

9. Any inquires concerning this communication or earlier communications from the examiner should be directed to Chuck O. Kendall who may be reached via telephone at (703) 308-6608. The examiner can normally be reached Monday through Friday between 8:00 A.M. and 5:00 P.M. est.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Dam *can be* reached at (703) 305-4552.



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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-3900.

*For facsimile (fax) send to 703-7467239 official and 703-7467240 draft*

*Chuck B. Kendall*

*Software Engineer Patent Examiner*

A handwritten signature in black ink, appearing to read 'Tuan Dam', with a stylized flourish at the end.

**TUAN DAM  
SUPERVISORY PATENT EXAMINER**